

## **REMARKS**

### **Status of the Claims**

Claims 1, 3, 5-7 and 9-11 are currently pending in the application. Claims 1-7 and 9 stand rejected. The Examiner objects to claim 3. Claims 1 and 3 have been amended. Claims 2 and 4 have been cancelled. All amendments and cancellations are made without prejudice or disclaimer. New claims 10 and 11 have been added. No new matter has been added by way of the present amendments. Specifically, the amendment to claim 1 is supported by the specification at, for instance, page 4, line 17 to page 5, line 2. The amendment of claim 3 is to address objections to the claims, as suggested by the Examiner. New claims 10 and 11 are supported by the specification at least at page 6, lines 3-9. Reconsideration is respectfully requested.

### **Objections to the Claims**

The Examiner objects to claim 3. (*See*, Office Action of December 18, 2007, at page 2, hereinafter, "Office Action"). The Examiner states that claim 3 should refer to claims 1 and 2 in the alternative only. Claim 3 has been amended to clearly be in the alternative.

Reconsideration and withdrawal of the objection to claim 3 are respectfully requested.

**Rejections Under 35 U.S.C. § 102(b)**

Claims 1-5, 7 and 9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Ishii et al., EP 1459804 (hereinafter, "Ishii et al."). (See, Office Action, at pages 2-5). Claims 2 and 4 have been cancelled without prejudice or disclaimer, thus obviating the rejection of these claims. Applicants traverse the rejection as to the remaining claims as set forth herein.

The Examiner states that Ishii et al. disclose production of organic compounds with catalysts comprising a cyclic acylurea structure with the formula (I). The Examiner further states that Ishii et al. disclose at page 39 the conversion of p-xylene into terephthalic acid in the presence of cobalt (II) acetate and manganese (II) acetate at 100-150 degrees for 12-14 hours. The Examiner states that continuous feeding of the catalytic nitrogen compound and continuous extraction of the reaction mixture from the reactor are inherent parameters in the reaction.

Although Applicants do not agree that the present invention is anticipated by the disclosure of Ishii et al., to expedite prosecution, claim 1 has been amended to additionally recite, in part, "a molar ratio of the catalytic nitrogen-containing cyclic compound A to the aromatic compound B in the reaction system of 0.01 or more; and an oxygen concentration in an offgas of 1% to 8% with the oxygen to be fed to the reaction system being an oxygen-containing gas containing oxygen in an amount of 10% to 50%." Support for this amendment may be found in the present specification at page 4, line 17 to page 5, line 2.

In the presently claimed invention, the oxygen to be fed to the reaction system is an oxygen-containing gas containing oxygen in an amount of 10% to 50%, and the oxygen concentration in the offgas is 1% to 8%.

The production efficiency of the target compound, and the utilization efficiency of the catalyst often decreases under conditions of an excessively low oxygen concentration in the offgas. In contrast, it may be very unsafe to use excessively high oxygen concentration in the offgas.

In the presently claimed invention, the oxygen-containing gas, which contains oxygen in an amount of 10% to 50%, is continuously introduced into the reactor through its bottom so that the oxygen concentration in the offgas line is 1% to 8%. Then, terephthalic acid is produced in a high yield with a conversion from p-xylene of 92-100%. (See, for instance, Examples 1-13 in the present specification).

On the other hand, in Examples 19 and 20 of Ishii et al., the reaction is carried out in the presence of a high concentration of oxygen, such as at 1 atm (= 0.1 MPa; oxygen concentration 100%). In Example 21 of Ishii et al., the autoclave is charged with 2MPa of air (oxygen concentration 20%), and the reaction is carried out in batch for 12 hours, which is much longer than the reaction time in the present invention.

In the presently claimed invention, a catalytic nitrogen-containing cyclic compound A with molecular oxygen enables oxidation of an alkyl group bound to an aromatic ring under mild conditions.

Accordingly, Ishii et al. do not disclose the presently claimed feature of an oxygen-containing gas, which contains oxygen in an amount of 10% to 50%, and which is continuously introduced into the reactor so that the oxygen concentration in the offgas line is 1% to 8%. Thus, Ishii et al. cannot anticipate the presently claimed invention because Ishii et al. do not disclose all of the limitations of the presently claimed invention. Anticipation requires that "each and every

element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” (*See, In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2d 1949 (Fed. Cir. 1990), quoting *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987)).

Dependent claims 3, 5-7 and 9-11 are believed to not be anticipated as, *inter alia*, depending from a non-anticipated base claim, amended claim 1.

Reconsideration and withdrawal of the anticipation rejection of claims 1, 3, 5-7 and 9 are respectfully requested.

#### **Rejections Under 35 U.S.C. § 103(a)**

Claims 1-7 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable as obvious over Ishii et al. and Narihisa et al., JP 2003128618 (hereinafter, “Narihisa et al.”), in light of Turner et al., U.S. Patent No. 6,307,099 (hereinafter, “Turner et al.”). (*See*, Office Action, at pages 5-9). Claims 2 and 4 have been cancelled without prejudice or disclaimer, thus obviating the rejection of these claims. Applicants traverse the rejection as to the remaining claims as set forth herein.

At paragraph 14, page 8 of the Office Action, the Examiner states that Ishii et al. and Narihisa et al. do not disclose or suggest utilization of a plurality of reactors to generate the aromatic carboxylic acid. The Examiner also admits that these references do not disclose or suggest the level of the aromatic compound in the downstream-most reactor. However, the Examiner states that Turner et al. disclose these limitations and that one of ordinary skill in the art would be motivated to combine the disclosure of Turner et al. with that of Ishii et al. or

Narihisa et al. The Examiner states that Ishii et al., at paragraph [0126], suggests utilization of a "batch system, semi-batch system, continuous system or another conventional system." The Examiner states that this discussion in Ishii et al. provides sufficient motivation for one of ordinary skill in the art to investigate this possibility and combine the methods of Ishii et al. with that of Turner et al.

As commented on above, Applicants do not agree that the claims are anticipated or obvious in light of the cited references. Nonetheless, in an effort to expedite prosecution, Applicants have amended claim 1 herein as described above. Applicants believe that, for similar reasons, the combination of references cited by the Examiner also do not make the presently claimed invention obvious because the cited references do not disclose or suggest all of the limitations of the presently claimed invention.

In addition to the comments provided above distinguishing the presently claimed invention over the disclosure of Ishii et al., Applicants provide the following additional comments which further differentiate the presently claimed invention over the combined disclosures of the references cited under 35 U.S.C. § 103(a).

For instance, in Examples 1 and 2 of Narihisa et al., the autoclave was charged with 2-3MPa of oxygen and 2MPa of nitrogen, and the reaction was carried out in batch mode at a high oxygen concentration.

Turner et al. disclose in column 7 lines 18-22 that: "This aspect of the invention is particularly applicable to the case where the reaction zone is formed, at least in part, by a plug flow reactor and is particularly beneficial where the oxidant is in the form of *substantially pure*

*oxygen or an oxygen enriched gas.*" (See, Turner et al., at column 7, lines 18-22, emphasis added).

Turner et al. further disclose that: "The oxidant in each of the foregoing aspects of the invention is conveniently molecular oxygen, e.g. *substantially pure oxygen*, air or other oxygen containing gas (i.e. gas containing oxygen as the major or minor constituent thereof), or oxygen dissolved in liquid. *The use of substantially pure oxygen as the oxidant has the benefits of avoiding gas voidage and disruption of plug flow profile while affording high oxygen mass transfer rates required for intensified reaction at modest operating pressures.*" (*Id.* at lines 35-43, emphasis added).

Turner et al. also disclose that: "FIG. 2 is a flow sheet illustrating one form of oxidation reactor scheme that may be used in the process of the present invention employing *substantially pure oxygen or oxygen enriched gas as the oxidant.*" (*Id.* at column 10, lines 48-51, emphasis added).

Finally, Turner et al. disclose the following: "For instance, where the oxygen is supplied in the form of a *gas containing 80% oxygen and 20% nitrogen*, the system operating pressure will be typically in excess of about 75 bara" and "Because in this embodiment, *substantially pure oxygen is employed as the oxidant, nitrogen or other inert gas is supplied to the crystallisation process via line 84 to ensure that the vent gas recovered via line 86 is not flammable.*" (*Id.*, at in column 15, lines 20-23 and column 17 lines 3-7, respectively, emphasis added).

In contrast, in the presently claimed invention, a catalytic nitrogen-containing cyclic compound A with molecular oxygen enables oxidation of an alkyl group bound to an aromatic ring under mild conditions.

Turner et al. do not disclose or suggest conducting the reaction such that the oxygen-containing gas, containing oxygen in an amount of 10% to 50%, is continuously introduced into the reactor to adjust the oxygen concentration in the offgas line to 1% to 8%.

Therefore, reconsideration and withdrawal of the obviousness rejection of claims 1, 3, 5-7 and 9 are respectfully requested.


### **CONCLUSION**

If the Examiner has any questions or comments, please contact Thomas J. Siepmann, Ph.D., Registration No 57,374, at the offices of Birch, Stewart, Kolasch & Birch, LLP.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to our Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

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Respectfully submitted,

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